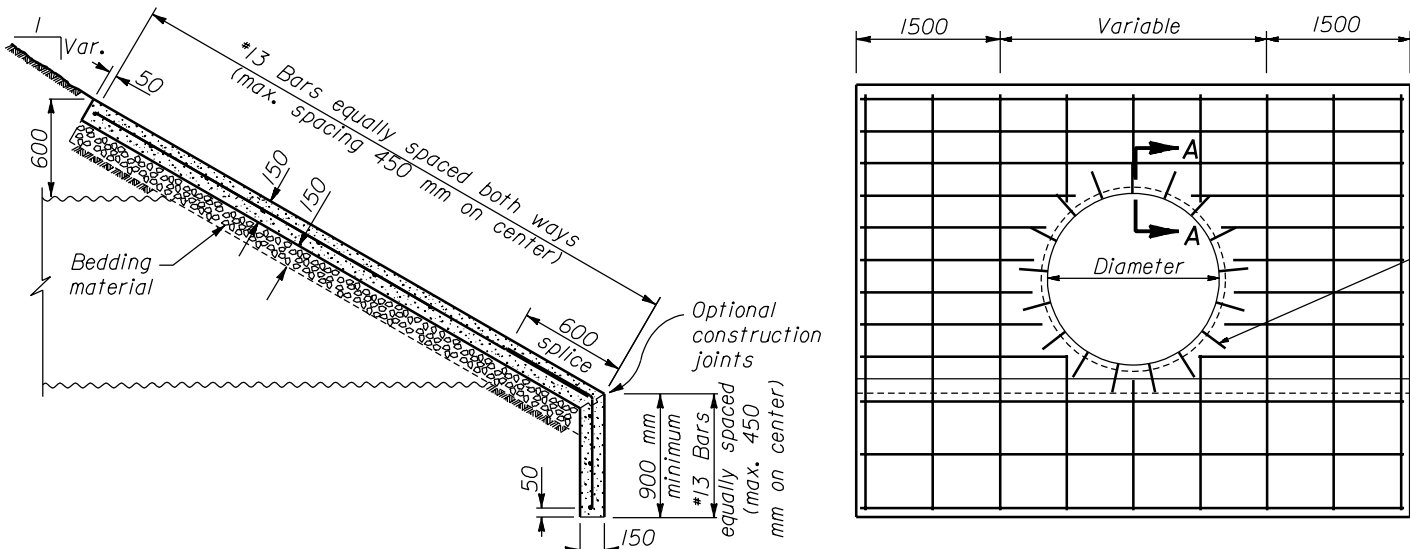
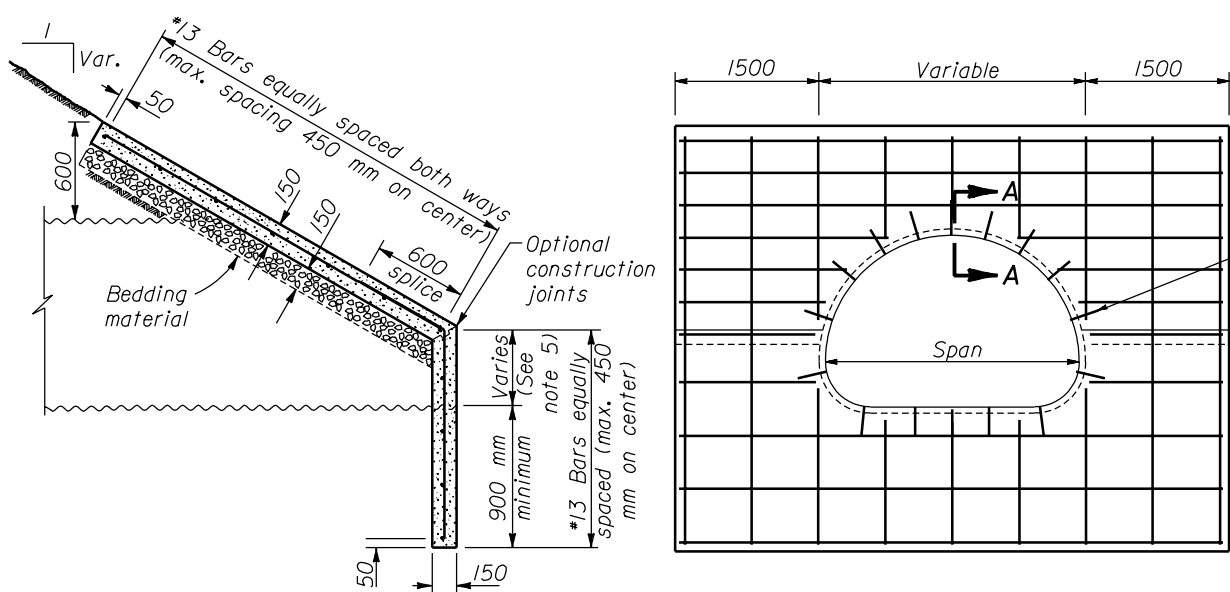


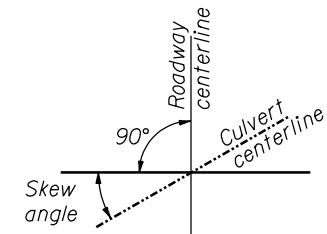
TYPE A STEP BEVEL FOR ROUND PIPE



TYPE B FULL BEVEL FOR ROUND PIPE



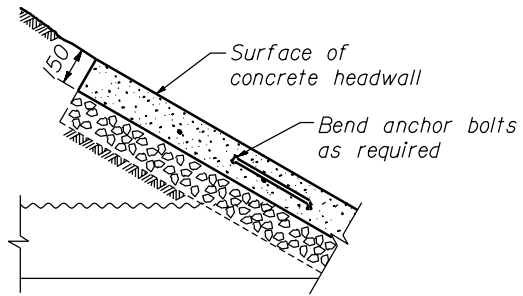
STEP BEVEL FOR PIPE ARCH CULVERT



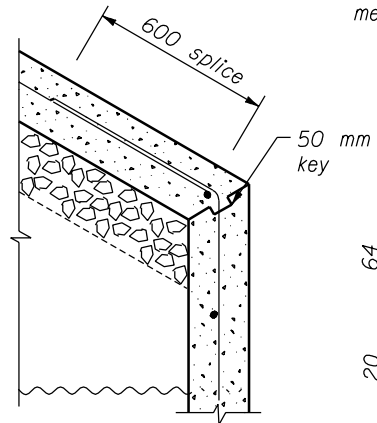
SKEW ANGLE DIAGRAM

REINFORCED CONCRETE HEADWALL				
STEP BEVEL PIPE ARCH CULVERT				
PIPE ARCH SIZE	SKEW ANGLE			
	0°	15°	30°	45°
Span x rise	Concrete (m3)			
1855 x 1400	2.4	2.6	2.8	3.5
2060 x 1500	2.7	2.8	3.1	3.8
2415 x 1700	3.1	3.2	3.3	4.4
2845 x 1905	3.4	3.5	3.9	4.7
3480 x 2210	3.8	4.0	4.4	5.4
3910 x 2540	4.5	4.6	5.1	6.3
4240 x 2615	4.7	4.9	5.4	6.7
4675 x 3150	5.0	5.2	5.8	7.1
4955 x 3300	5.6	5.7	6.3	7.3

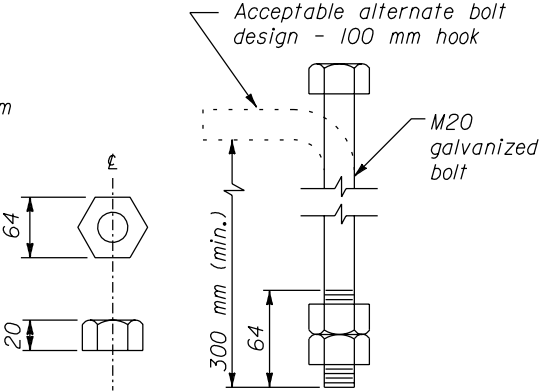
REINFORCED CONCRETE HEADWALL								
ROUND PIPE CULVERT								
PIPE SIZE	SKEW ANGLE							
	TYPE A STEP BEVEL				TYPE B FULL BEVEL			
	0°	15°	30°	45°	0°	15°	30°	45°
Diameter	Concrete (m3)				Concrete (m3)			
1200	2.5	2.5	2.6	2.8	2.2	2.4	2.7	2.7
1500	2.8	2.8	2.9	3.1	2.8	2.8	2.9	3.1
1800	3.1	3.1	3.2	3.4	3.2	3.3	3.4	3.5
2100	3.4	3.5	3.6	3.8	3.7	3.7	3.8	4.1
2400	3.9	4.0	4.1	4.4	4.1	4.1	4.3	4.5
2700	4.3	4.4	4.5	4.8	4.5	4.6	4.7	5.1
3000	4.6	4.7	4.8	5.2	5.0	5.0	5.2	5.6
3300	5.3	5.4	5.6	6.0	5.4	5.5	5.7	6.1
3600	5.7	5.7	6.0	6.5	5.9	6.0	6.2	6.7
3900	6.0	6.1	6.3	7.0	6.4	6.5	6.7	7.3
4200	6.6	6.7	7.0	7.6	6.9	7.0	7.3	8.0
4500	6.8	7.0	7.2	7.8	7.4	7.5	7.8	8.5



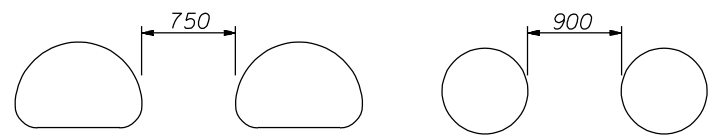
SECTION A-A



CONSTRUCTION JOINT DETAIL



ANCHOR BOLT DETAIL



PIPE-ARCHES

ROUND PIPES

MULTIPLE PIPE INSTALLATION

NO SCALE

NOTE:

1. Dimensions not labeled are in millimeters.
2. CONCRETE: Chamfer all exposed edges 20 mm.
3. REINFORCING STEEL: Grade 420 (ASTM A 615M-, 96A, A 616, or A 617) deformed billet steel bars conforming to AASHTO M 31. The minimum concrete cover to the face of any bar is 50 mm unless otherwise shown.
4. HEADWALL TYPE: Use Type A Step Bevel headwalls for round pipe unless otherwise specified in the special contract requirements.
5. STEP BEVEL: The variable dimension indicated for the height or step conform to manufacturer's recommendations unless otherwise specified in the special contract requirements.
6. CUTOFF WALLS: The minimum depth shown may be reduced in solid rock, provided wall is keyed into the rock at least 300 mm.
7. ANCHOR BOLTS: Conform to ASTM A 307. Galvanize in accordance with ASTM A 153.
8. BEDDING: Construct a firm and uniform foundation before placing the bedding. Use clean 10 mm sandy material for bedding unless otherwise specified in the special contract requirements.
9. ESTIMATED QUANTITIES: The concrete quantities are based on a 900 mm cut-off wall and 1:1.5 fill slopes for each of the skew angles. Interpolate concrete quantities for headwalls not shown. Reinforcing steel is estimated at 32 kg/m3 of concrete excluding the weight of the anchor bolts.
10. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.

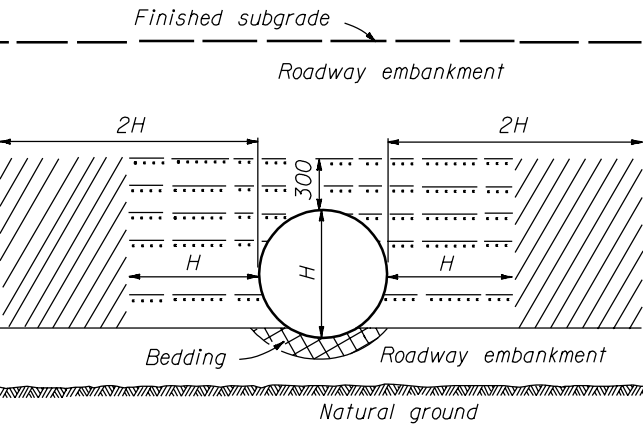
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION

METRIC DETAIL

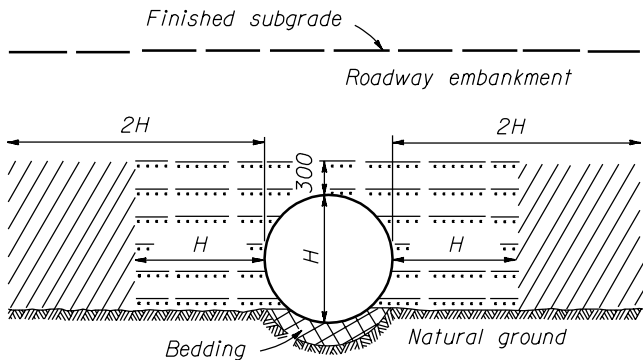
REINFORCED CONCRETE
HEADWALL

DETAIL APPROVED FOR USE 3/1996
REVISED: 5/1997 3/2000

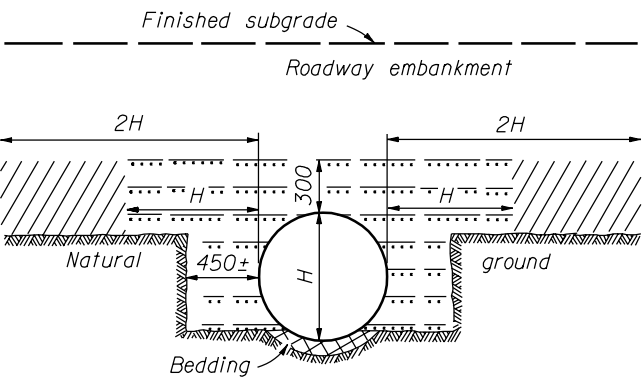
DETAIL
WM601-50



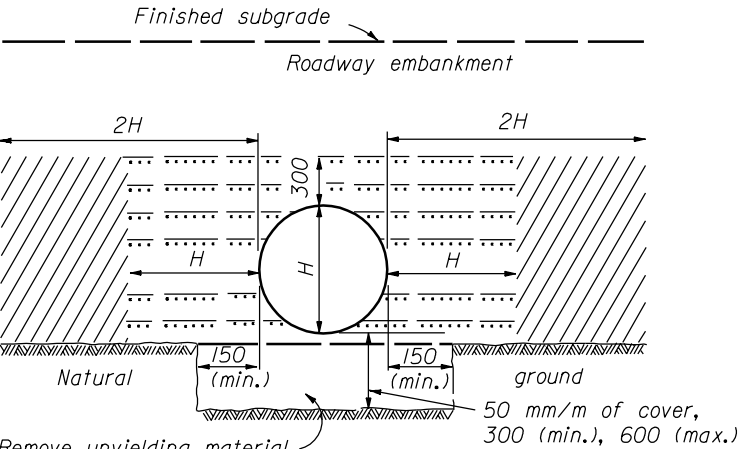
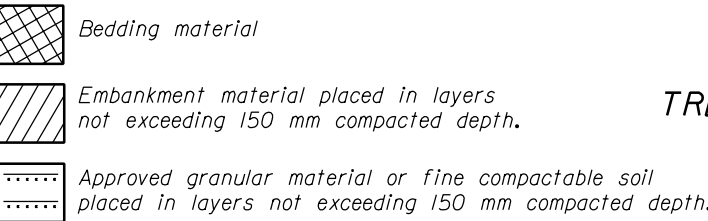
ABOVE NATURAL GROUND



ON NATURAL GROUND

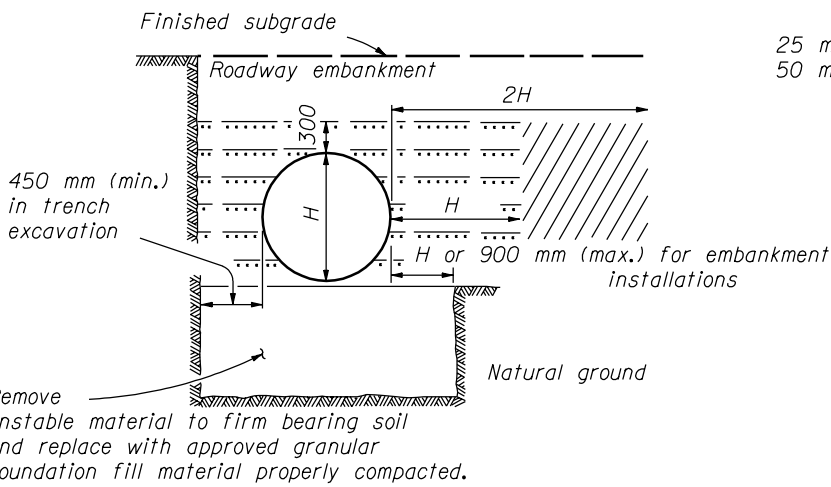


ABOVE AND BELOW NATURAL GROUND



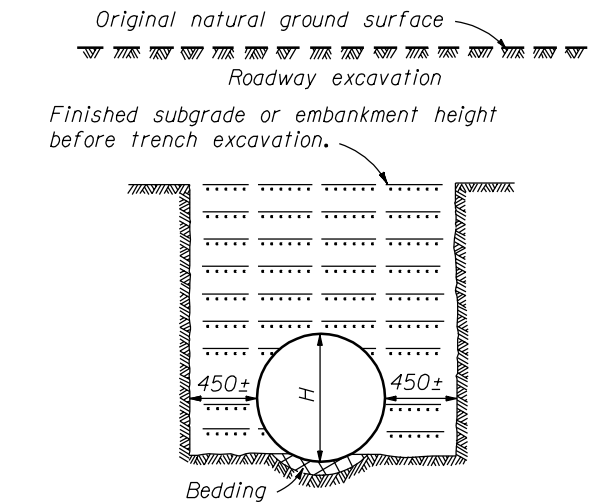
Remove unyielding material and replace with selected fine compressible material. Lightly compact in layers not over 150 mm in uncompacted depth.

ON UNYIELDING MATERIAL

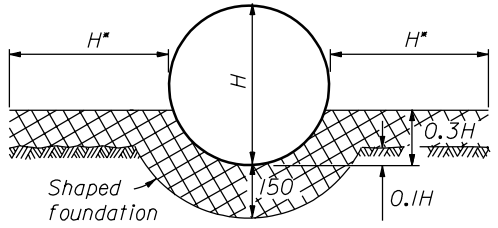


Remove unstable material to firm bearing soil and replace with approved granular foundation fill material properly compacted.

ON UNSTABLE MATERIAL

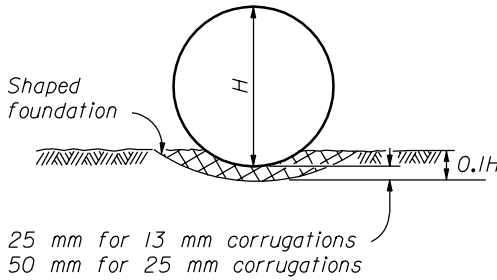


BELOW NATURAL GROUND OR TRENCH EXCAVATION IN EMBANKMENT

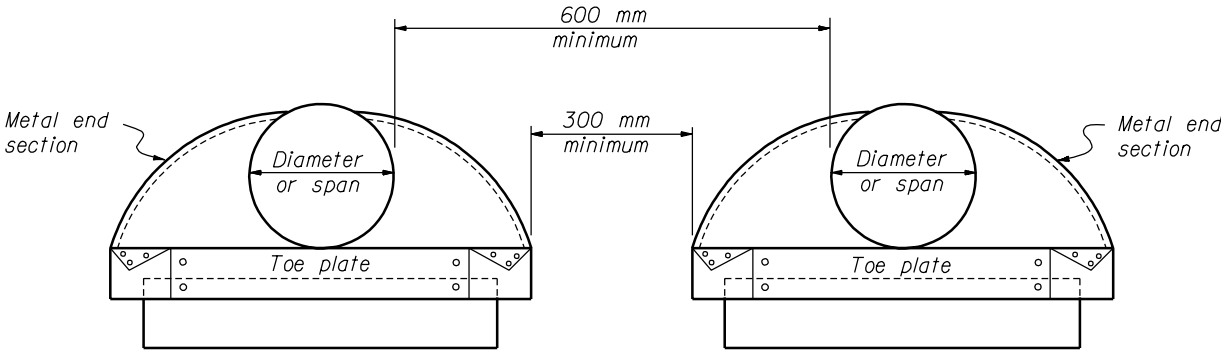


*Reduce to 450 mm for trench excavations.

CLASS B BEDDING

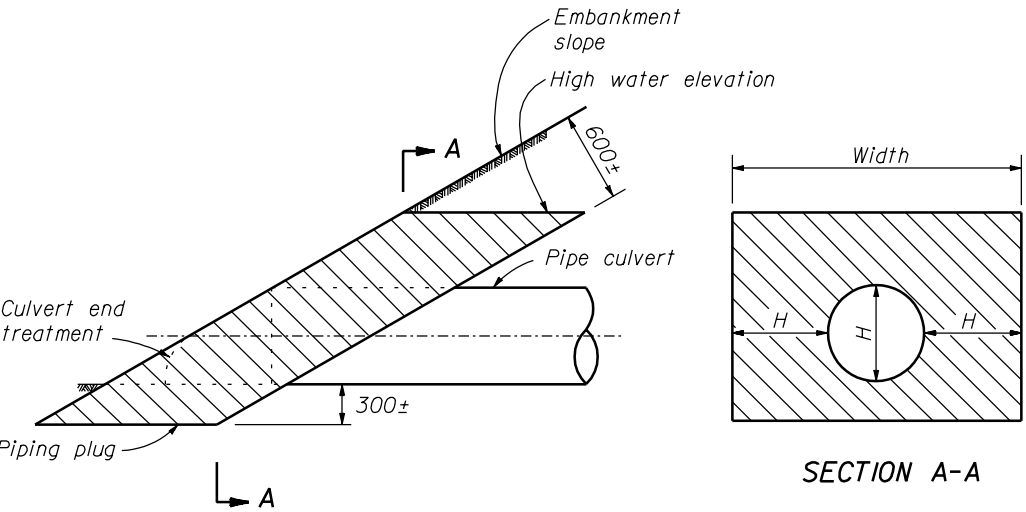


CLASS C BEDDING



ELEVATION

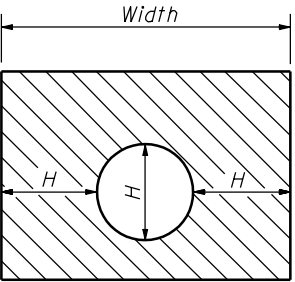
ELEVATION



PIPING PLUG

Construct piping plug of impermeable backfill material at the pipe culvert inlet where granular material is used for backfill. Width may be adjusted to tie into impervious material.

SECTION A-A



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION
METRIC DETAIL
METAL AND PLASTIC
PIPE CULVERT BEDDING FOR
MINOR CULVERTS

NOTES:

1. Dimensions not labeled are in millimeters.
2. When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
3. Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for both flexible and rigid pavement.
4. Use metal end sections for all plastic pipe installations where end sections or bevels are specified.

POLYETHYLENE (PE) PLASTIC ROUND PIPE CULVERT																
FILL HEIGHT TABLE AND MINIMUM CELL CLASSIFICATION NUMBER PER ASTM D 3350																
SMOOTH WALL, CORRUGATED AND RIBBED PIPE CULVERT																
SMOOTH WALL (SOLID WALL)									CORRUGATED				RIBBED			
PIPE SIZE	MINIMUM COVER	CELL CLASSIFICATION NUMBER 335434C							PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 324420C (1)	CELL CLASS. NO. 315412C (2)	PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 334433C (1)	CELL CLASS. NO. 335434C (2)
		MINIMUM WALL THICKNESS														
		15.4	21.7	23.4	29.3	35.1	32.8	37.5								
DIAMETER	MAXIMUM FILL HEIGHT IN METERS								DIAMETER	MAXIMUM FILL HEIGHT IN METERS			DIAMETER	MAXIMUM FILL HEIGHT IN METERS		
300	300	17.5							300	300	3.0	3.5	450	300	5.5	7.5
450	300		16						375	300	3.0	3.5	600	300	6.5	8.5
600	300			11.5					450	300	3.0	3.5	750	300	6.5	8.5
750	300				11.5				600	300	3.0	3.5	900	300	7.5	9.5
900	300					11.5			750	300	3.0	3.5	1050	300	6.5	8.0
1050	300						8.0		900	300	3.0	3.5	1200	300	6.5	8.0
1200	300							8.0								

POLYVINYL CHLORIDE (PVC) PLASTIC ROUND PIPE CULVERT									
FILL HEIGHT TABLE AND MINIMUM CELL CLASSIFICATION NUMBER PER ASTM D 1784									
SMOOTH WALL AND RIBBED PIPE CULVERT									
SMOOTH WALL (SOLID WALL)						RIBBED			
PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 12454C		CELL CLASS. NO. 12364C		PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 12364C	CELL CLASS.
		MINIMUM WALL THICKNESS						NO. 12364C	NO. 12454C
		9.1	11.1	9.1	11.1			(1)	(2)
DIAMETER		MAXIMUM FILL HEIGHT IN METERS				DIAMETER		MAXIMUM FILL HEIGHT IN METERS	
300	300	20		21		300	300	8.0	11.0
375	300		19		20	375	300	6.5	9.5
						450	300	7.0	10.0
						600	300	6.5	9.0
						750	300	6.0	8.5
						900	300	6.0	8.5
						1050	300	5.5	8.0
						1200	300	5.5	7.5

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
WESTERN FEDERAL LANDS HIGHWAY DIVISION

METRIC DETAIL

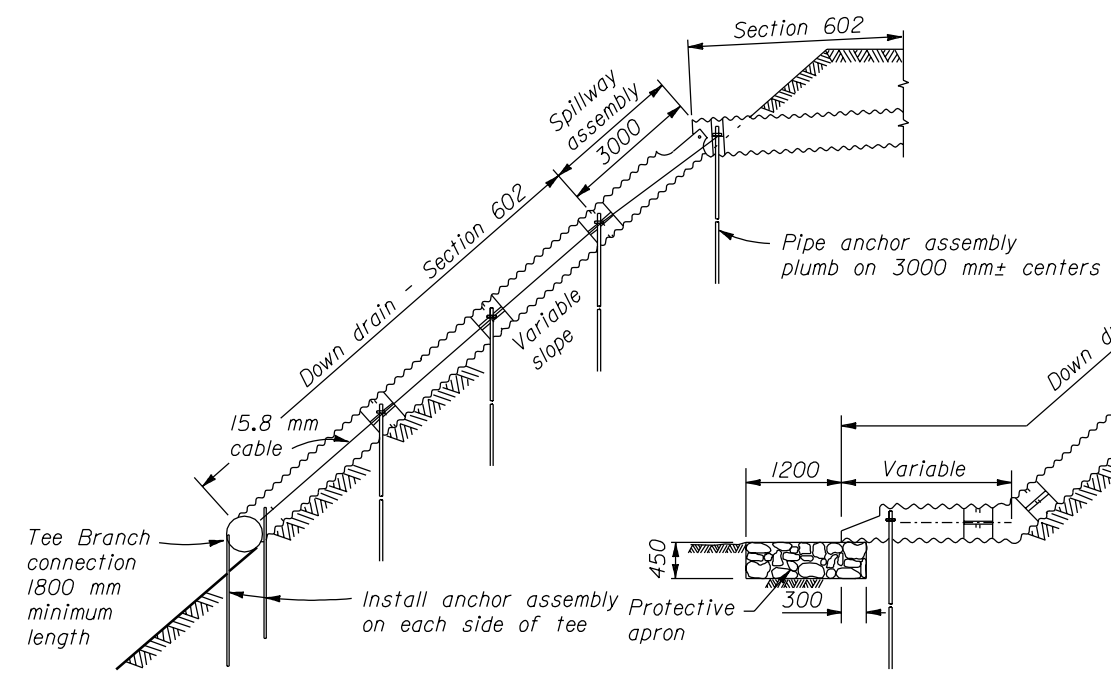
PLASTIC PIPE CULVERT

DETAIL APPROVED FOR USE 3/1999

REVISID:

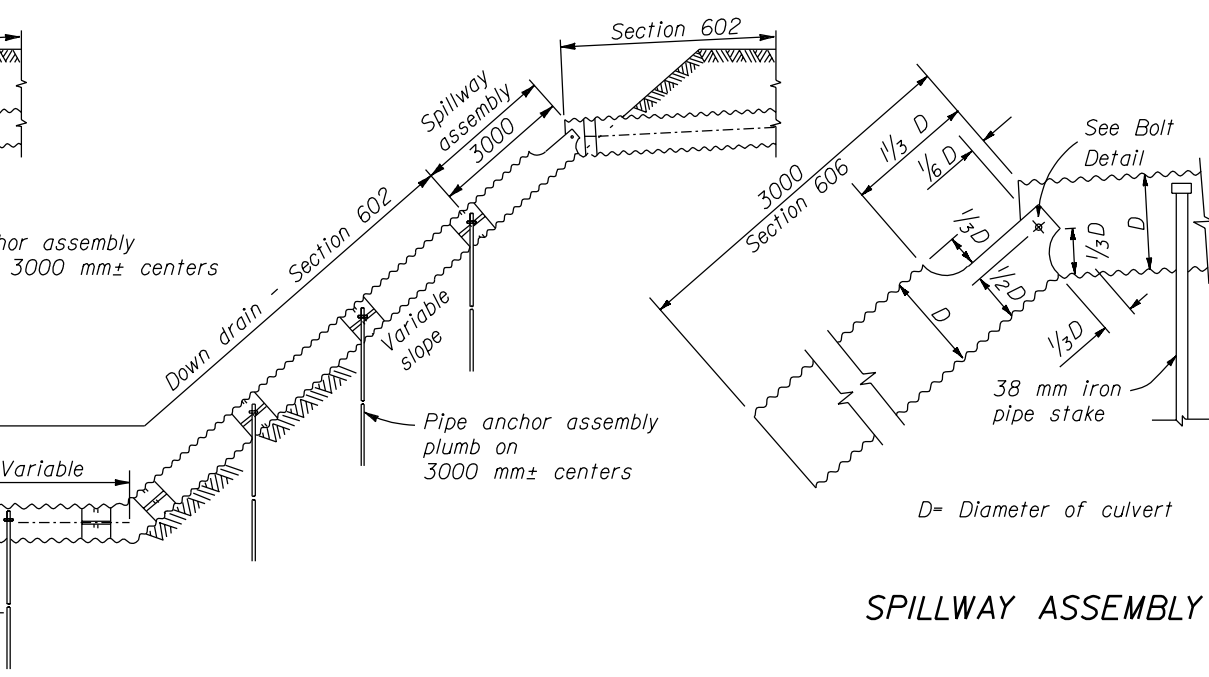
DETAIL
WM602-5

NO SCALE



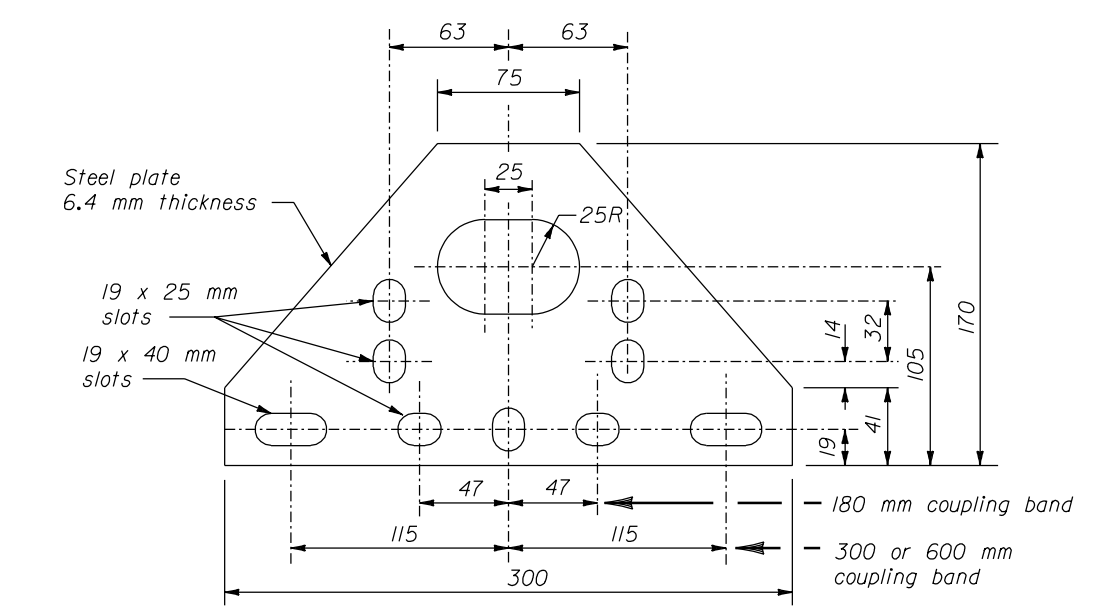
ELEVATION

SPILLWAY ASSEMBLY WITH DOWN DRAIN
OUTLET ON NON-ERODIBLE MATERIAL

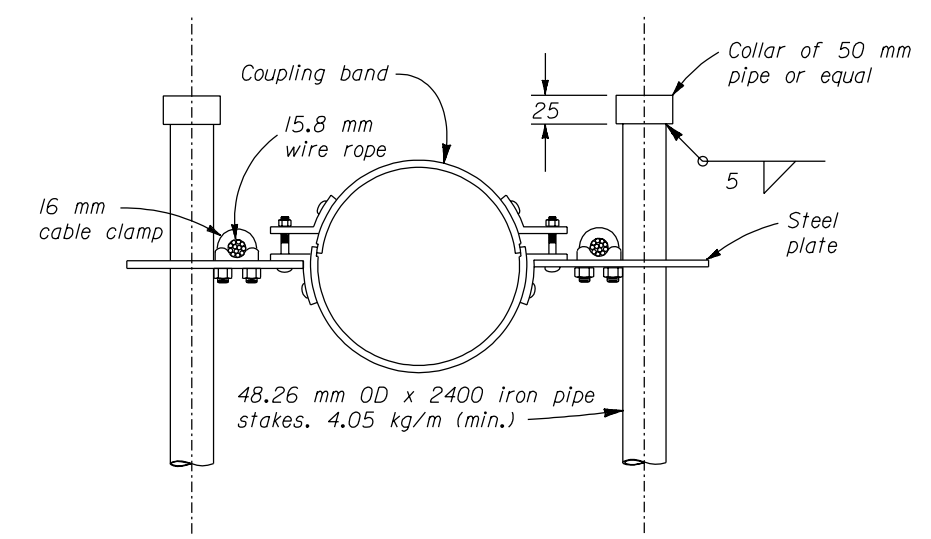


ELEVATION

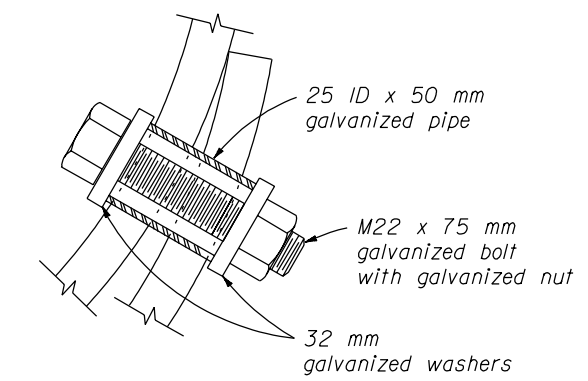
SPILLWAY ASSEMBLY WITH DOWN DRAIN
OUTLET ON ERODIBLE MATERIAL



STEEL PLATE



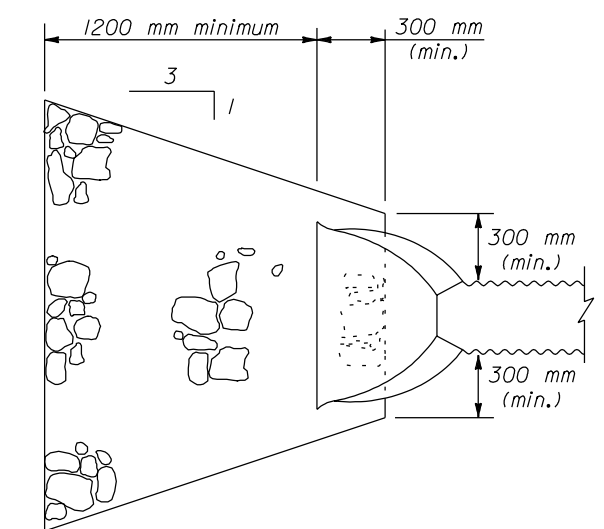
ANCHOR ASSEMBLY



BOLT DETAIL

NOTE:

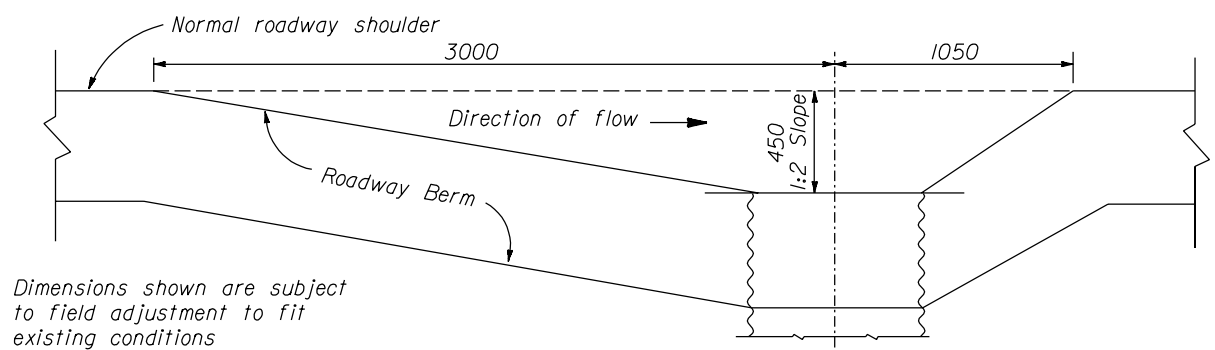
1. Dimensions not labeled are in millimeters.
2. Fabricate spillway assembly from annular corrugated pipe, or from helically corrugated pipe with factory annular or reformed ends. Use 1.6 mm galvanized steel or 1.5 mm aluminum.
3. Make all banded connections watertight by placing 5 mm bead of approved caulking under each half of the band before tightening.
4. Payment for Tee Branch connection under Section 602 is included in the linear foot measurement for culvert pipe for the applicable sizes. Measure Tee Branch connections along the top of the Tee.
5. Place Class 2 riprap conforming to Section 251 for protective apron.
6. Galvanized all items of anchor assembly after fabrication.
7. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.
8. Approved alternate designs may be used.



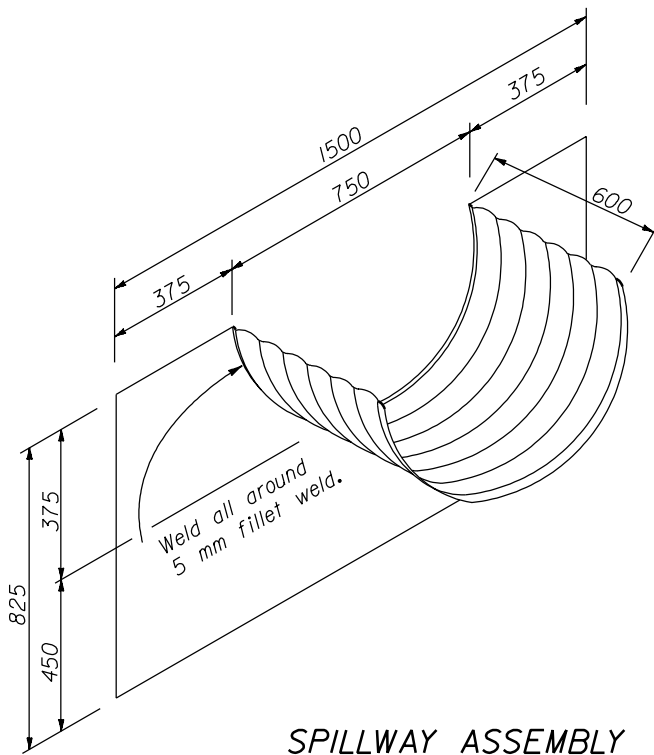
PLAN
PROTECTIVE APRON

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL	
SPILLWAY ASSEMBLY WITH DOWN DRAIN	
DETAIL APPROVED FOR USE 3/1996	DETAIL
REVISED:	WM606-50

NO SCALE



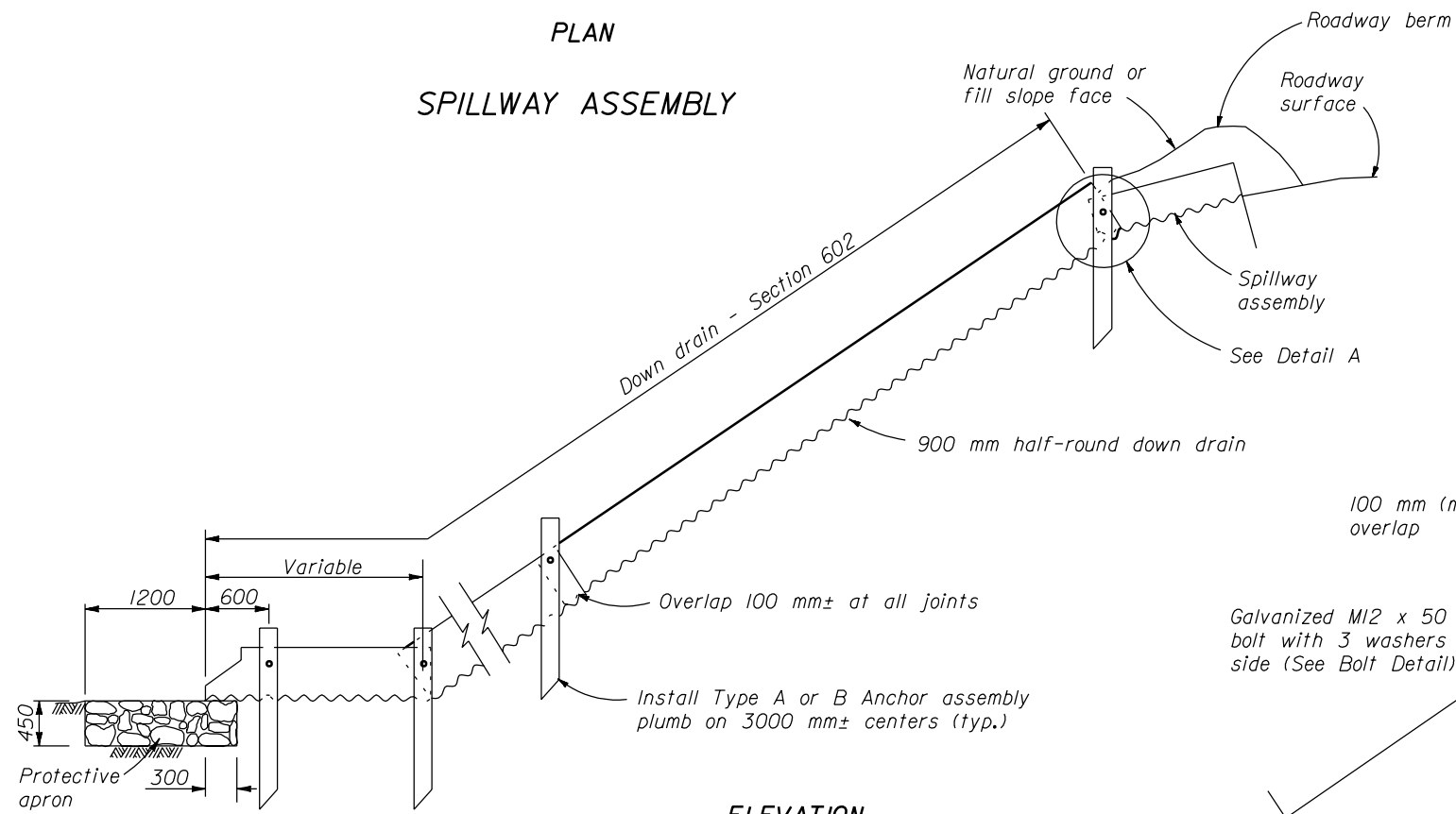
PLAN
SPILLWAY ASSEMBLY



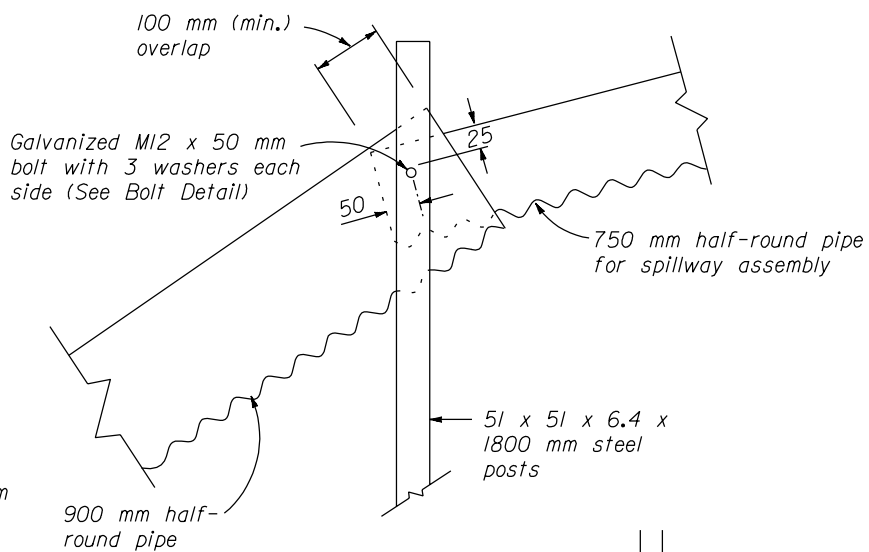
SPILLWAY ASSEMBLY

NOTE:

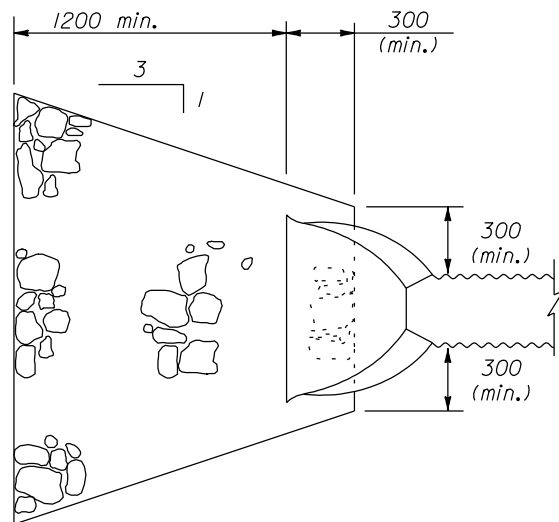
1. Dimensions not labeled are in millimeters.
2. Fabricate spillway assembly from 1.6 mm thick galvanized steel or 1.5 mm aluminum.
3. Place Class 2 riprap conforming to Section 251 for protective apron.
4. Construct down drain from annular corrugated pipe, or from helically corrugated pipe with factory annular or flanged reformed ends.
5. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.
6. Approved alternate designs may be used.



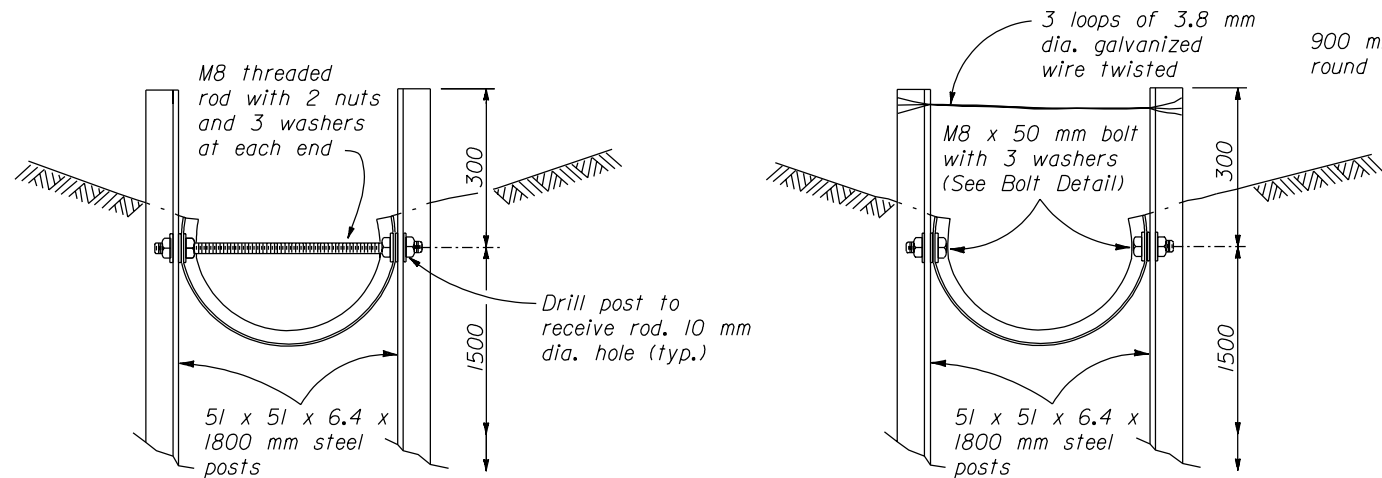
ELEVATION
SPILLWAY ASSEMBLY AND DOWN DRAIN



DETAIL A



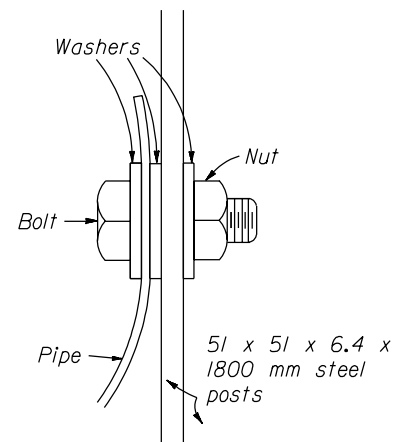
PLAN
PROTECTIVE APRON



TYPE A

ANCHOR ASSEMBLY

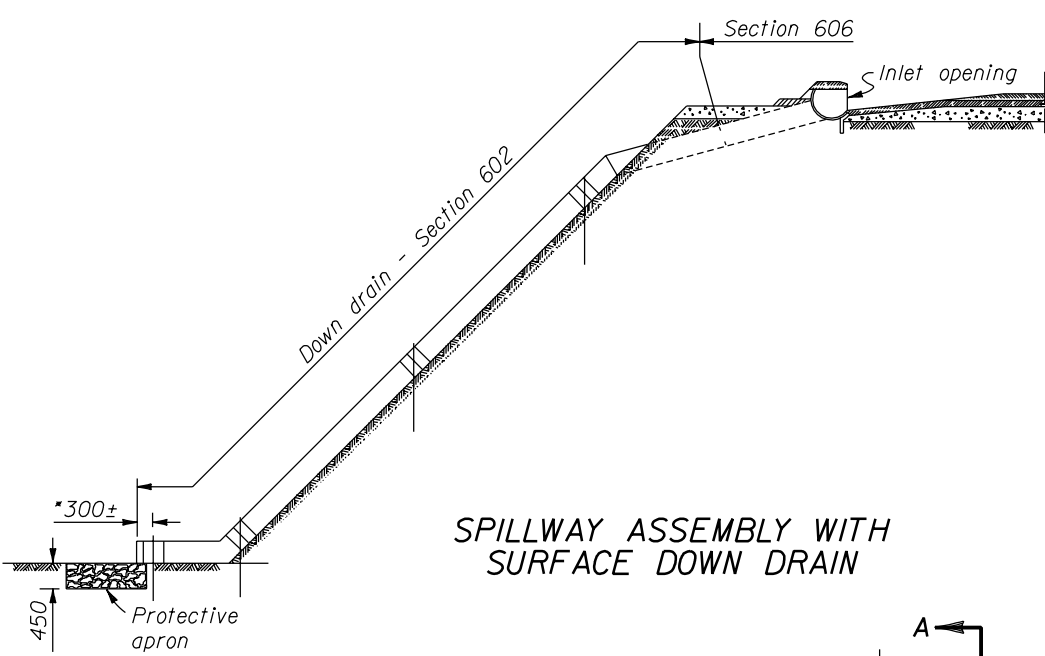
TYPE B



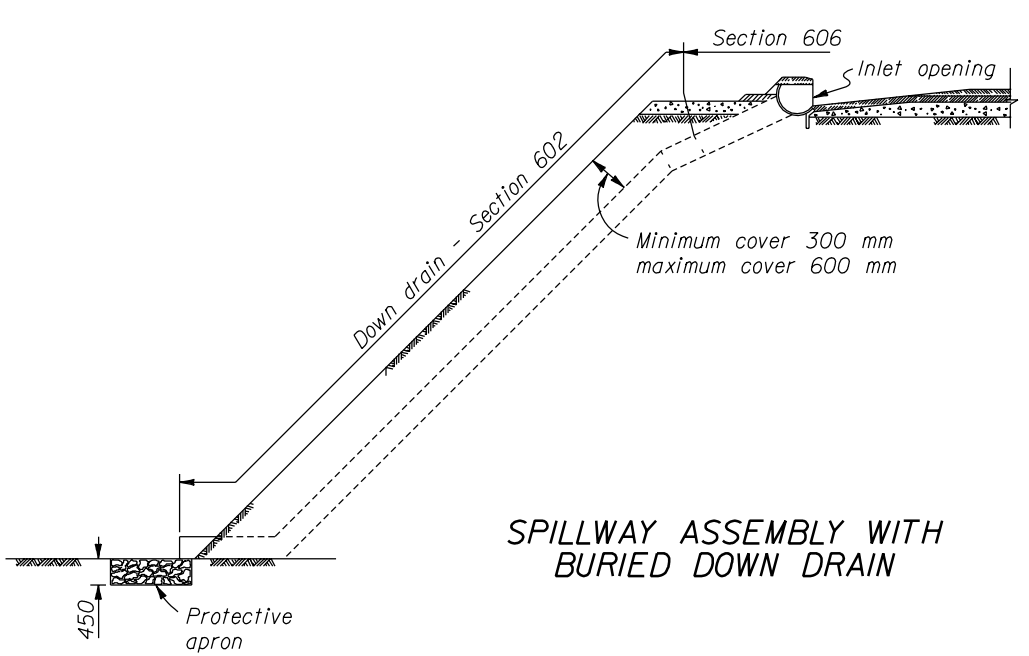
BOLT DETAIL

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL	
SPILLWAY ASSEMBLY WITH HALF-ROUND DOWN DRAIN	
DETAIL APPROVED FOR USE 3/1996	DETAIL
REVISED: 3/1999 3/2000	WM606-52

NO SCALE

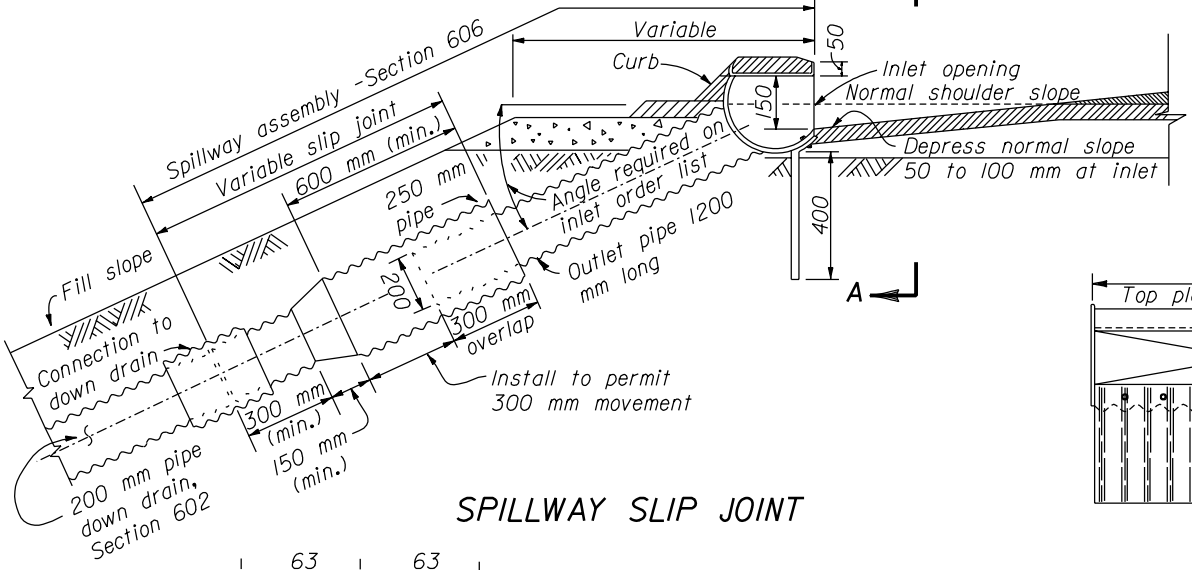


SPILLWAY ASSEMBLY WITH SURFACE DOWN DRAIN

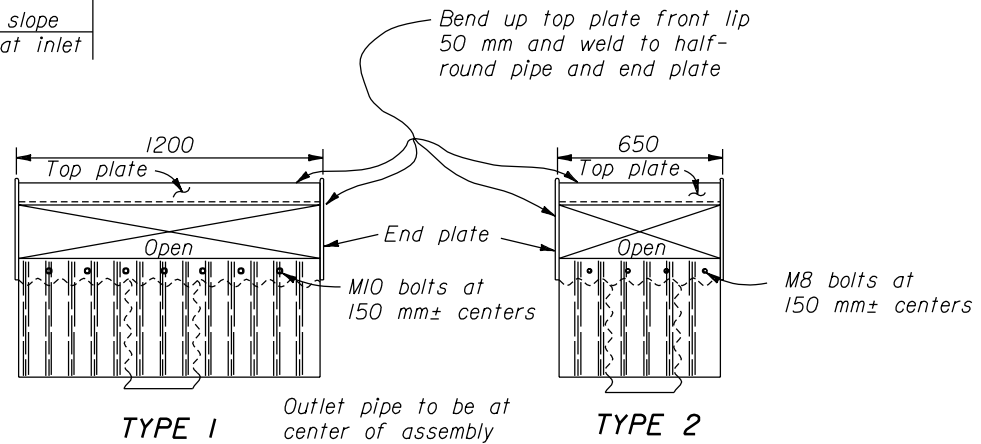


SPILLWAY ASSEMBLY WITH BURIED DOWN DRAIN

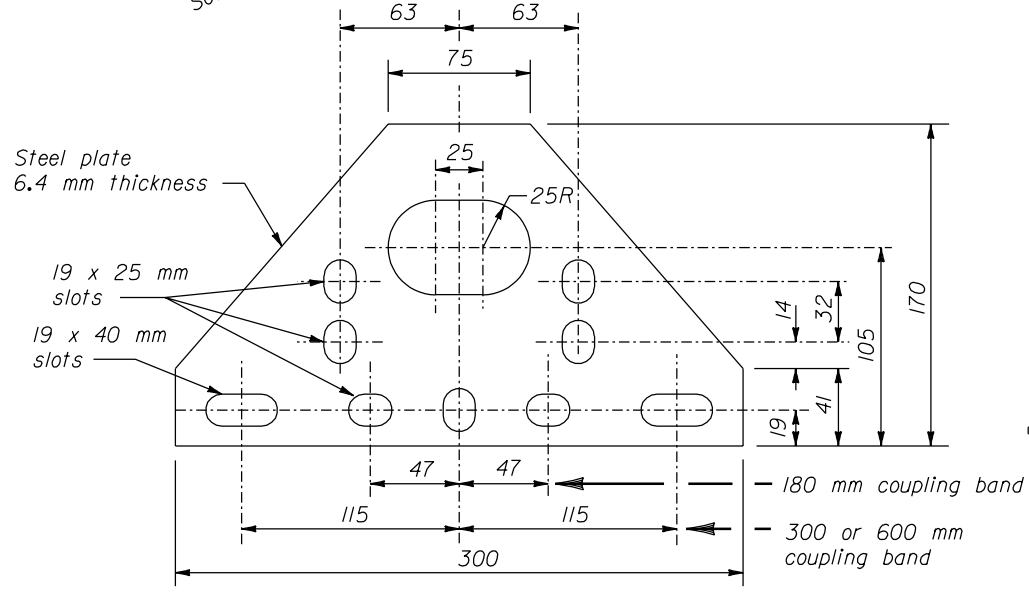
- NOTE:**
1. Dimensions not labeled are in millimeters.
 2. Fabricate half-round pipe, outlet pipe, and curtain wall for spillway assembly from 1.6 mm galvanized steel or 1.5 mm aluminum. Fabricate top plate and end plate from 4.6 mm flat steel or 5.0 mm aluminum plate. Fabricate tapered portion of slip joint from either flat or corrugated sheets.
 3. Make all coupling band connections watertight by placing a 5 mm bead of approved caulking under each half of the band before tightening.
 4. Install pipe anchor assemblies at 3000 mm± spacing on down drain installed above ground.
 5. Use Type 2 spillway assembly inlets where profile grades are greater than 2 percent. Use Type 1 on grades 2 percent or flatter.
 6. Place class 2 riprap conforming to Section 251 for protective apron.
 7. Galvanized items of the anchor assembly after fabrication.
 8. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.
 9. Approved alternate designs may be used.



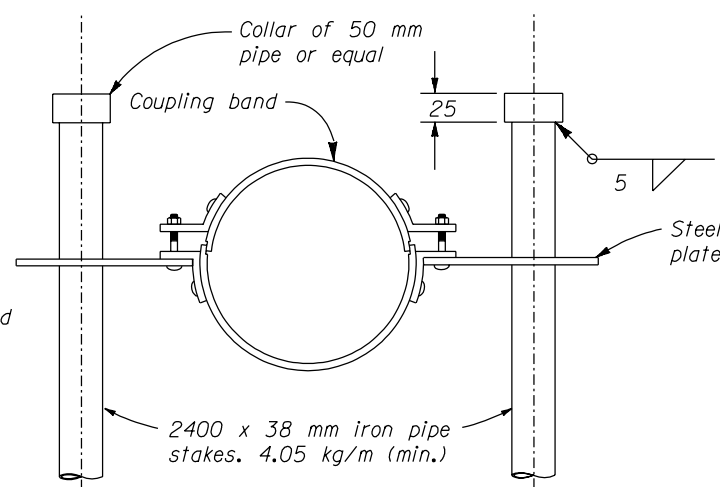
SPILLWAY SLIP JOINT



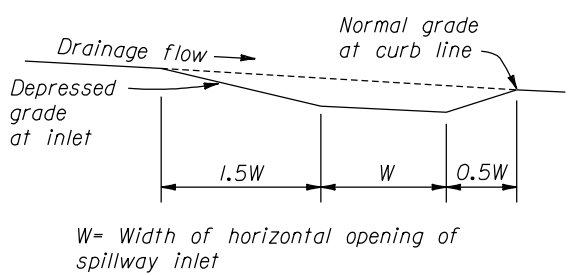
SECTION A-A
SPILLWAY ASSEMBLY INLETS



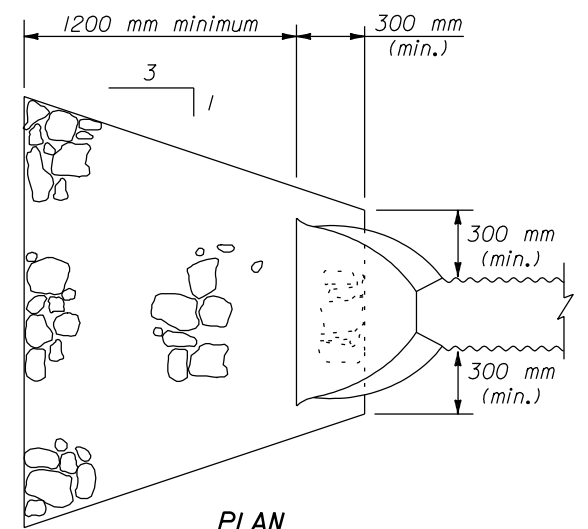
STEEL PLATE



ANCHOR ASSEMBLY



SCHEMATIC PROFILE OF INLET BASIN



PLAN
PROTECTIVE APRON

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL	
CORRUGATED METAL SPILLWAYS AND INLETS	
DETAIL APPROVED FOR USE 3/1996	DETAIL
REVISED:	WM606-53